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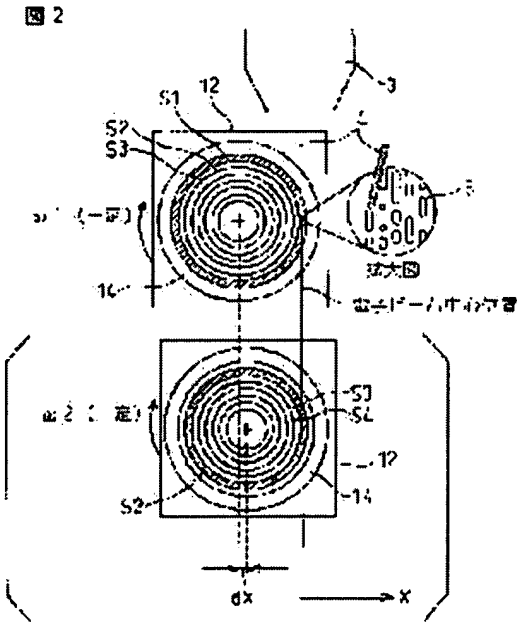
(54) MASTERING DEVICE AND MANUFACTURING METHOD OF SUBSTRATE FOR STORAGE MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To form the line of pits of nanometer order on an original disk while using a linearly-movable stage which is not so high in precision of positioning.

SOLUTION: In this mastering device, the linearly-movable stage 12 is intermittently moved to stop while using the linearly-movable stage 12 having micron- order precision in positioning together with the deflecting function of an electron gun in the direction of the radius of an original disk 12, and the adjustment of a position, where an electron beam 4 irradiated from an electron beam column 3 forms an image, is made within a range of the movement of the linearly- movable stage 12 under the condition that a rotation stage is rotated at most at an rotation speed at which the shake of an axis is constant, and then the pits are exposed to light with extremely high density on the original disk 14.



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CLAIMS

[Claim(s)]
[Claim 1] The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, In and the condition of having laid the base by which was equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage, and resist spreading was carried out on said rotation stage, and having made it rotating By irradiating on this base and exposing an electron beam from said electron beam irradiation equipment Mastering equipment characterized by having the driving gear which drives said direct-acting stage so that it may move to the predetermined distance [every] intermittence target which is mastering equipment which manufactures disk original recording, and by which said direct-acting stage was appointed beforehand.
[Claim 2] It is mastering equipment according to claim 1 characterized by for said electron beam irradiation equipment irradiating an electron beam on said base when said direct-acting stages are [a idle state and said rotation stage] operating state, and performing adjustment of the exposure location of said electron beam of the migration direction of said direct-acting stage with the polariscope prepared in said electron beam irradiation equipment.
[Claim 3] The driving gear which drives said rotation stage when said electron beam irradiation equipment irradiates an electron beam on said base is mastering equipment according to claim 1 or 2 characterized by operating so that the rotational speed of said rotation stage may be held to the constant speed which axial blurring cannot produce easily.
[Claim 4] It is mastering equipment given in any 1 term of claims 1-3 characterized by for said electron beam irradiation equipment repeating the same electron beam exposure of the count of predetermined in the same part on said base when it turns out beforehand that exposure runs short in the exposure of the electron beam of the once to said base top by said electron beam irradiation equipment, and suspending actuation of said direct-acting stage in the meantime.
[Claim 5] The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, And it is the manufacture approach of the storage substrate which uses the mastering equipment equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage. In the condition that laid the disk original recording by which resist spreading was carried out on said rotation stage, and actuation of said direct-acting stage has stopped Said disk original recording is rotated with a fixed rotational speed by said rotation stage. Irregularity is formed on disk original recording by being deviation within the limits of an electron beam, irradiating said electron beam irradiation equipment to an electron beam on this disk original recording, and exposing. When the exposure in deviation within the limits of the electron beam by said electron beam irradiation equipment is completed Were able to appoint said direct-acting stage beforehand, carry out predetermined distance migration, and it is made to stop. Henceforth The exposure in deviation within the limits of said electron beam irradiation equipment to an electron beam, The manufacture approach of the storage substrate characterized by repeating migration of an intermittent predetermined distance of said direct-acting stage, creating La Stampa from said disk original recording,

performing injection molding of a transparent material using this La Stampa, and obtaining a storage substrate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the mastering equipment which can draw to disk original recording with high recording density, and the storage substrate which used this mastering equipment, without making positioning accuracy of a direct-acting stage into high definition especially about the manufacture approach of the mastering equipment which draws the disk original recording for information record, and a storage substrate with an electron beam.
[0002]
[Description of the Prior Art] Conventionally, the mastering equipment which draws the disk original recording for information record with an electron beam or laser is known. This mastering equipment irradiates a direct laser beam and an electron beam, is moving original recording to radial, forms the train of a groove or a pit spirally on original recording, and makes the original recording which a resist is applied and is rotating complete disk original recording through processes, such as development, plating, and injection plastic surgery, after that.
[0003] In the optical disk in which the write-in possibility using [of] the optical MAG, a phase change, etc. of and rewriting are possible, while a land or a groove is formed, address information, and a sector mark and control information are formed in a pit. In an optical disk like CD-ROM or DVD-ROM, not only address information but data are formed in a pit. In a land / groove record, the truck of a land/groove can be formed by forming a truck slot and making irregularity.
[0004] In order to make it arrange not concentric circular but spirally and to draw a truck slot and a pit train on disk original recording, the stage device equipped with the rotation stage which rotates disk original recording at high speed, and the direct-acting stage which makes radial carry out continuation migration of the disk original recording smoothly at a super-low speed is required. Original recording manufacture of an optical disk etc. has so far been performed by the mastering equipment which used the laser beam. However, the recording density of a disk is improving rapidly in recent years, and the limitation appeared in the recording density of a disk in the original recording manufacture by the mastering equipment which used the laser beam.
[0005] Now, the recording density of DVD is 3.3Gbit extent per 1 square inch, and a track pitch is 740nm. In order to set this to 100Gbit(s) per [which is 30 times the recording density of DVD] 1 square inch, the track pitch of a disk must be set to 140nm. It is impossible to, obtain 70nm (one half of a track pitch) required to draw the pattern of the consistency of 100Gbit(s) per 1 square inch since the limitation of the diameter of the beam spot by the laser beam is 250nm (half-value width) extent on the other hand. It is the reason which has a limitation in the recording density of the disk by the mastering equipment with which this used the laser beam.
[0006] Then, in order to raise recording density sharply in recent years, instead of a laser beam, the mastering equipment using an electron beam is made as an experiment increasingly. And if drawing linear velocity in a point with a radius [of disk original recording] of 58mm is carried out in 8m/second under the conditions of setting the track pitch of a disk to 140nm, with the mastering equipment using

this electron beam in order to make it the recording density of 100Gbit(s) per for example, 1 square inch, the feed rate of a direct-acting stage will serve as 3 micrometer/s.
[0007]
[Problem(s) to be Solved by the Invention] However, the positioning accuracy of a direct-acting stage is difficult for fixing a feed rate and controlling it by micron order or submicron order correctly per second in the present condition, although the thing of nm order also exists. And when delivery of a direct-acting stage was not performed correctly, this effect appeared also in the drawn pattern and there was a trouble that high density and high-definition original recording could not be manufactured.
[0008] That is, although it is necessary to carry out uniform migration of the direct-acting stage at a super-low speed when a track pitch is made into high density, there is a problem of the friction field of a drive system and the densification of the further track pitch is impossible in the present condition. On the other hand, about the rotation stage in mastering equipment, the rotational speed to which axial blurring tends to become large, and the rotational speed which axial blurring cannot produce easily exist. Generally, although axial blurring of a rotation stage is measured and amendment is performed by the deviation of an electron beam, high-resolution-ization of the amount of deviations of an electron beam must be attained as the recording density of a disk improves. This is a direction which narrows the amount of deviation amendments of an electron beam, and is a direction which stops being able to amend the error of delivery of a direct-acting stage easily.
[0009] It explains in more detail about this trouble. The super-low-speed uniform motion of a direct-acting stage cannot expect stability by inertial force, and its effect of the nonlinear frictional force of a drive is large, and "it is smooth migration microscopically" becomes difficult. Although a direct-acting stage location is detected at the time of drawing and a deviation operation of an electron beam amends a beam exposure location, if the amendment serves as 10nm order or less than [it], and a high speed, a limitation will be generated also in the amount of amendments. Moreover, about a rotation stage, blurring which synchronized with the rotation, and asynchronous random blurring arise. These can observe that each becomes large or becomes small depending on the rotational speed of a rotation stage.
[0010] Furthermore, although drawing to the original recording of a high density optical disk is performed by the electron beam, the data disk which did in this way and was manufactured in large quantities is played by the laser beam. The method of reading the data on two adjoining trucks to coincidence as an approach reading in this case is taken. For this reason, a track pitch must be held correctly and densification of the further track pitch is desired.
[0011] Then, the purpose of this invention canceling the trouble of the mastering equipment which used said conventional electron beam, and positioning accuracy using the direct-acting stage of micron order When the deviation function of the radial electron gun of a disk is used together, and it is in the successive range of this direct-acting stage, it is made to perform drawing justification to this and axial blurring chooses the rotational speed below a fixed value about a rotation stage It is in offering the manufacture approach of the mastering equipment which can expose a pit by super-high density on original recording, and a storage substrate.
[0012]
[Means for Solving the Problem] The mastering equipment of this invention which attains said purpose The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, In and the condition of having laid the base by which was equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on the rotation stage, and resist spreading was carried out on the rotation stage, and having made it rotating By irradiating on this base and exposing an electron beam from electron beam irradiation equipment In the mastering equipment which manufactures disk original recording, it is characterized by constituting so that the predetermined distance [every] intermittence target by which the direct-acting stage was appointed beforehand may be moved with the driving gear which drives a direct-acting stage at the time of manufacture of disk original recording.
[0013] When a direct-acting stage is a idle state and a rotation stage is operating state, an electron beam is made to irradiate on a base and the polariscope in which it was prepared by electron beam irradiation

equipment is made to perform adjustment of the exposure location of the electron beam of the migration direction of a direct-acting stage in this electron beam irradiation equipment. Things are made. Moreover, when electron beam irradiation equipment irradiates an electron beam on a base, the rotational speed of a rotation stage can be made to hold to the constant speed which axial blurring cannot produce easily with the driving gear which drives a rotation stage. The rate which axial blurring cannot produce easily in the rotational speed of a rotation stage changes with systems.

[0014] Furthermore, when it turns out beforehand that exposure runs short, it can be made to be able to carry out by the ability repeating the same electron beam exposure of the count of predetermined in the same part on a base with electron beam irradiation equipment, and actuation of a direct-acting stage can be made to suspend in the meantime in the exposure of the electron beam of the once to the base top by electron beam irradiation equipment. On the other hand, the manufacture approach of the storage substrate of this invention of attaining said purpose The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, And it is the manufacture approach of the storage substrate which uses the mastering equipment equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on the rotation stage. In the condition that laid the disk original recording by which resist spreading was carried out on the rotation stage, and actuation of a direct-acting stage has stopped Disk original recording is rotated with a fixed rotational speed by the rotation stage. An electron beam from electron beam irradiation equipment When it is deviation within the limits of an electron beam, irregularity is formed on disk original recording by irradiating on this disk original recording and exposing and the exposure in deviation within the limits of the electron beam by electron beam irradiation equipment is completed Were able to appoint the direct-acting stage beforehand, carry out predetermined distance migration, and it is made to stop. Henceforth The exposure in deviation within the limits of electron beam irradiation equipment to an electron beam, It is characterized by repeating migration of an intermittent predetermined distance of a direct-acting stage, creating La Stampa from disk original recording, performing injection molding of a transparent material using this La Stampa, and obtaining a storage substrate.

[0015] When exposing spirally to disk original recording according to the manufacture approach of the mastering equipment of this invention, and a storage substrate A bigger distance than the track pitch of the pit train on disk original recording, a groove, or a land in the condition that make it move intermittently by the direct-acting stage, and disk original recording is rotating with constant speed By deflecting the direction of the electron beam by which outgoing radiation is carried out with deflecting system in 1 time of this direct-acting stage of a successive range from the electron gun of electron beam irradiation equipment Since the control limitation of a direct-acting stage and a rotation stage is compensated and exposure is performed on disk original recording, a track pitch is high density 170nm or less, and high-definition disk original recording and a high-definition storage substrate can be manufactured.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on the concrete example shown in an accompanying drawing. Drawing 1 (a) The configuration of the mastering equipment 9 which used the electron beam which applies this invention is shown. The control circuit 2 which performs control of the stage device in the sample room 1 which contains the disk original recording 14, and the electron beam column 3 which generates the electron beam which irradiates the disk original recording 14, and is controlled and the sample room 1, and control of the DENSHI beam column 3 is established in mastering equipment 9.

[0017] The direct-acting stage 12 which moves the disk original recording 14 to radial [that], and the rotation stage 13 which rotates the disk original recording 14 are on that base 11 at the sample room 1, and the disk original recording 14 is laid on this rotation stage 13. There are standing-ways 12B fixed on the base 11 and movable carriage 12A which moves in this standing-ways 12B top in the direct-acting stage 12. The interior of the sample room 1 is held by the vacuum pump which is not illustrated at the high vacuum.

[0018] Drawing 1 (b) Nut 12C protrudes on the base of movable carriage 12A, and this nut 12C is contained in slot 12D formed in the center section of standing-ways 12B at the longitudinal direction so that it may be shown. The ball thread 18 is screwed on nut 12C, and this ball thread 18 is connected to the revolving shaft of the motor 19 attached in the vacuum chamber 10 of the sample room 1. Moreover, roller 12E is prepared between movable carriage 12A and standing-ways 12B, and movable carriage 12A can move now smoothly in a standing-ways 12B top.
[0019] On the other hand, the reflective mirror 16 is formed in the top face of movable carriage 12A. This reflective mirror 16 reflects the laser beam by which outgoing radiation was carried out from the external laser light source 21, and incidence was carried out to the interferometer 22 through the range measurement aperture 17 of the vacuum chamber 10. It goes into an interferometer 22 through the range measurement aperture 17 again, it is reflected here, and incidence of the reflected laser beam is carried out to a receiver 23. A receiver 23 detects the interference light which shows the location of movable carriage 12A from the laser beam which received light, and outputs to the laser interferometer control board 24. The laser interferometer control board 24 processes the interference light from inputted movable carriage 12A, detects the migration length of movable carriage 12A, and makes the position signal which shows the current position of movable carriage 12A. This position signal is sent out to the reversal input of a comparator 25.
[0020] Moreover, in order to change the focus of an electron beam corresponding to the wave of the vertical direction when rotating the disk original recording 14 laid on the rotation stage 13, the original recording height detector 15 which carries out the firm measurement of the height of the disk original recording 14 is formed in the top face of the vacuum chamber 10 of the sample room 1. The electron beam column 3 consists of the electron gun 31 made to generate an electron beam in the lens-barrel 30, the lenses 32, 36, and 37 which carry out expansion focusing of the beam, Branka 33 who performs ON/OFF of an electron beam, aperture (aperture diaphragm) 34 which you extract [aperture] the diameter of an electron beam and makes it pass, and deflecting system 35 which amends the current beam position irradiated by the principal plane of the disk original recording 14. Outgoing radiation of the electron beam finally extracted with the lens 37 is carried out from the outgoing radiation aperture 38 prepared in the point of a lens-barrel 30, and it is irradiated by the principal plane of the disk original recording 14.
[0021] ON/OFF of Branka 33 are controlled by the output of a controller 20. By the controller 20, the target position of movable carriage 12A calculates, and the signal of this target position is outputted to the noninverting terminal of a comparator 25. Since the current location of movable carriage 12A is inputted into the comparator 25 as mentioned above, in this comparator 25, the difference of the target position and the current position of movable carriage 12A is searched for as a locational error, and this locational error is outputted to a control circuit 26. In a control circuit 26, the signal which amends the exposure location of an electron beam based on this locational error signal is generated, and this is inputted into the deviation amplifier 27. From the deviation amplifier 27, an amendment signal is outputted to deflecting system 35, and the beam-spot location of electronic PIMU is controlled by the target position by amending the field of deflecting system 35.
[0022] Moreover, a controller 20 outputs a rotation driving signal to a motor 19, and controls rotation of a motor 19. The migration length of movable carriage 12A is controlled by this control. a motor 19 -- electromagnetism -- even if it may use any of a motor, a pulse motor, and an ultrasonic motor and uses the motor of ********, positioning of mum order is possible. What is necessary is to carry out continuation migration of the direct-acting stage 12 by the motor 19, and just to carry out continuation rotation also of the rotation stage 13 with constant speed, when the pattern consistency which draws to the disk original recording 14 is not so high. However, if the pattern consistency which draws to the disk original recording 14 becomes high, the controllability ability of the direct-acting stage 12 runs short. That is, the mechanical direct-acting stage 12 is difficult for positioning the disk original recording 14 by the order of NANOMETA, and moving with constant speed by the order of a micron.
[0023] So, in this invention, the mechanical direct-acting stage 12 is made paying attention to positioning by micron order being possible, although it is difficult to move with constant speed by

micron order. That is, in this invention, it is made to draw by the order of NANOMETA to the disk original recording 14 by positioning the disk original recording 14 by the order of a micron by the direct-acting stage 12, and positioning the location of an electron beam by the order of NANOMETA by impressing a field to an electron beam from deflecting system 35 from the electron beam column 3, where the direct-acting stage 12 is fixed.

[0024] Drawing 2 compares and shows the range which can draw by migration of the range which can draw, and the next direct-acting stage 12 by one migration of the direct-acting stage 12 in the mastering equipment of this invention. The drawing surface of the disk original recording 14 is beforehand divided into the approximately concentric circle-like drawing field like the first drawing field S1, the next drawing field S2, its next drawing field S3, and ...., as shown in drawing 12 . The radial width of face of the disk original recording 14 of each drawing field is set to the value of the width of face to which the electron beam 4 from the electron beam column 3 can sway with deflecting system 35 (refer to drawing 1) within the limits.

[0025] After laying the disk original recording 14 in the direct-acting stage 12, where the direct-acting stage 12 is moved to the first drawing field S1, the center position (location which is not deflected) of the electron beam 4 by which outgoing radiation is carried out from the electronic PIMU column 3 is set up so that it may become in the center of the drawing field S1, as shown in drawing 3 . And the disk original recording 14 stops the direct-acting stage 12, when making it rotate with the fixed rotational speed omega 1 and drawing to the drawing field S1.

[0026] In this condition, deflecting an electron beam with deflecting system, an electron beam 4 is intermittently irradiated from the electron beam column 3 to the drawing field S1, as shown in the enlarged drawing of drawing 2 , the disk original recording 14 top is exposed and the pit train 5 is formed [while turning Branka on and off according to drawing data, and]. At this time, as deflecting system shows an electron beam 4 to drawing 3 , it deviates so that it may move to an inner circumference side from the periphery side of the disk original recording 14, and the pit train 5 is spirally formed from the periphery side of the disk original recording 14.

[0027] After drawing to the first drawing field S1 is completed, as shown in drawing 2 , only distance dX moves the direct-acting stage 12 in the direction of X, and the next drawing field S2 is located directly under the electron beam column 3. As shown in drawing 3 , supposing the migration length dX of this direct-acting stage 12 decides the deflection area of 140nm and an electron beam 4 to be 1 micrometer for a track pitch P, it can be determined as 980nm (=140nmx7) by using a part for 7 round as one step. Namely, what is necessary is just to move 980nm of direct-acting stages 12 at a time, after drawing by a unit of 7 round and completing drawing with an electron beam 4.

[0028] Moreover, rotational speed of the rotation stage 13 in each drawing field is fixed. However, when drawing fields differ, the rotational speed of each rotation stage 13 may be changed. In the example of drawing 2 , the rotational speed of the rotation stage 13 of the drawing field S1 is set up like omega 2 in the rotational speed of the rotation stage 13 of omega 1 and the drawing field S2. This has work of suppressing increase of the jitter under the effect of the complicated rotation unevenness by change of the rotational speed of the rotation stage 13. Furthermore, when the amplitude of rotation asynchronous shaft blurring chooses a small rotational speed as a rotational speed of the rotation stage 13, the amount of deviations of an electron beam can be made small, high-resolution-ization of the amount of deviations can be attained, and drawing of the more nearly high-definition disk original recording 14 can be performed.

[0029] In addition, the migration length dX in one step of the direct-acting stage 12 can also be set as criteria distance like 1 micrometer. In this case, as shown in drawing 4 , the disk original recording 14 will take 1/7 round (20 micrometers of migration length of a beam) for 7 rounds (980 micrometers of migration length of a beam) from the drawing start point A of the electron beam in a drawing field with the disk original recording 14 to the point B ending [drawing]. That is, the disk original recording 14 takes +1/7 round 7 round, and the migration length of an electron beam when the point B on the disk original recording 14 ending [drawing] comes to Point C is set to 1 micrometer.

[0030] In addition, although the movement magnitude of the direct-acting stage 12 per step is decided

and it is made to move a constant rate every here by the relation between the amount of deviations of an electron beam, and the track pitch on the disk original recording 14, movement magnitude of the direct-acting stage 12 may not be made into a constant rate, but fluctuation control may be carried out. The technique which carries out fluctuation control of the movement magnitude of this direct-acting stage 12 can be applied when changing a track pitch in the inner circumference section and the periphery section of the disk original recording 14.

[0031] Drawing 5 is the diagram showing the location of the direct-acting stage 12 as explained above, when the direct-acting stage 12 carries out migration migration intermittently with time amount. As this drawing shows, as for the direct-acting stage 12, it turns out that a location did not change, namely, it is not moving when drawing is performed to the drawing fields S1 and S2 and S3 .... By the way, where the migration stage 13 is rotated, when it exposes by irradiating an electron beam 4 on the disk original recording 14 from the electron beam column 3 with the rotational speed defined uniformly in each field as mentioned above, a desired pit pattern may not be obtained with lack of the amount of charges of an electron beam. This is understood when an electron beam is irradiated beforehand at test original recording. In such a case, lack of the amount of charges of an electron beam is suppliable by drawing multiple times and the same pattern with an electron beam in the same drawing field in the same part of the disk original recording 14.

[0032] Drawing 6 (a) (b) Two or more drawing procedures to the disk original recording 14 top by the electron beam are shown. Drawing 6 (a) It is a partial enlarged drawing explaining the drawing condition of the 1st pit, and is drawing 6 (b). The condition of performing 2nd drawing to the part on the disk original recording which drew once is explained. In the same drawing field, there are three kinds of approaches as follows among the approaches of drawing multiple times and the same pattern with an electron beam in the same part of the disk original recording 14. (1) The approach only the count of the need repeats again the actuation which irradiates an electron beam to all the trucks of a drawing field after irradiating an electron beam to all the trucks of a drawing field. (2) The approach draw with an electron beam by 1 round to the drawing field of disk original recording, and only the count of the need draws again to it repeatedly to the truck for 1 round which drawing finished. (3) The approach draw with an electron beam by predetermined two or more rounds to the drawing field of disk original recording, and only the count of the need draws again to it repeatedly to the truck for two or more rounds which drawing finished.

[0033] According to which this approach, by the exposure of the electron beam of the once to the disk substrate 14 top by the electronic beaker ram 3, when it turns out beforehand that exposure runs short, and only that of the count of predetermined repeats an exposure for the same electron beam successively in the same part on the disk base 14 gone around, a pit can be formed. Drawing 7 shows the configuration of mastering equipment 9A of another example of this invention, and, as for the mastering equipment 9 explained by drawing 1 , the configurations of the sample room 1 mainly differ. Therefore, the sign same about the same configuration member as the mastering equipment 9 explained by drawing 1 is attached, and the explanation is omitted about the configuration of the electron beam column 3 and a control circuit 2.

[0034] The sample room 1 of mastering equipment 9A is equipped with vacuum Champa 10 held by the vacuum pump which is not illustrated at the high vacuum. Inside vacuum Champa 10, the air spindle motor 40 as the direct-acting stage 42 which moves the disk original recording 14 to radial [the], and a rotation stage which rotates the disk original recording 14 is on the base 11, and the disk original recording 14 is laid on the rotation base 43 of the air spindle motor 40.

[0035] The direct-acting stage 42 is equipped with rod 42D which wheel 42B to which movable carriage 42A in which the air spindle motor 40 is attached, and movable carriage 42A are moved, and nut 42C fixed, and is constituted. The ball thread 48 is screwed on nut 42C, and this ball thread 18 is connected to the revolving shaft of the motor 19 fixed on the base 11 in the vacuum chamber 10. Movable carriage 42A can move now smoothly by wheel 42B in a base 11 top.

[0036] The pipe 41 is penetrated and attached in the air spindle motor 40, and the both ends of this pipe 41 are extended to the outside of the vacuum chamber 10, and are supported by the stanchion 46. And

the outside of the pipe 41 in the vacuum chamber 10 is airtightly covered with bellows 44, and the negative pressure in the vacuum chamber 10 rises by the open air. The tube 47 passes in the pipe 41 and the compressed air is sent in by the compressor (not shown) using this tube 47. After this compressed air rotates the air spindle motor 40, it is discharged outside from the other side of a tube 47. Furthermore, in order to perform the vacuum seal of the air spindle motor 40 positively using differential pumping, exhaust air actuation of the seal section is performed by the tube connected with the vacuum pump which is not illustrated. Moreover, the signal cable 45 is wired in the pipe 41.

[0037] And the electron beam column 3 which irradiates an electron beam 4 is attached in the disk original recording 14 at the upper brakes servo-motor 10 of the disk original recording 14. Since the internal configuration of this electron beam column 3 is the same as what was already explained in drawing 1 , it has stopped in this example for that appearance to only be shown. In addition, although the location of movable carriage 42A is detected also in this example using laser, since this detection equipment is already explained in drawing 1 , the illustration in this example and explanation are omitted. Corresponding to the wave of the vertical direction when rotating the disk original recording 14 laid on the rotation stage 43, in order to change the focus of an electron beam, the illustration and explanation are omitted also about the detector which measures the height of the disk original recording 14.

[0038] The wave of the vertical direction of the disk original recording 14 in the vacuum chamber 10 can be reduced by moving the direct-acting stage 42 within the vacuum chamber 10, and using the air spindle motor 40 driven by the compressed air. In addition, although the example explained above explained the example which performs drawing to the disk original recording 14 from the periphery side of the disk original recording 14, the direction which draws is good even from the inner circumference side of the disk original recording 14. Moreover, it is not limited especially about the revolution direction of the spiral formed in the disk original recording 14, either.

[0039] Thus, the manufactured disk original recording is used as La Stampa which creates a storage, and a storage substrate is created by injection molding. Then, a storage completes record film, a protective coat, etc. by being formed in the front face in which the pit and the truck slot were formed of sputtering. When a storage is CD, a protective coat is formed on reflective film, such as aluminum. Moreover, when a storage is MO, as record film, in the case of phase change media, such as magnetic films, such as TbFeCo and GdFeCo, and DVD-RAM, phase change film **s, such as GeSbTb, were formed upwards as record film, and the laminating of the transparent materials, such as SiN, is carried out as a protective coat. In addition, substrates are transparent materials, such as a polycarbonate.

[0040] Although the above-mentioned example explained the case where only a pit pattern was formed, it is also possible to draw in the combination of a truck slot, a truck slot, and a pit pattern. Moreover, although the example was explained taking the case of the electron beam as an electric charge beam, a beam like a focal DOION beam other than an electron beam can also be used.

[0041] In addition, although this example explained the storage with the optical disk, it is defined as being what also contains the medium of the shape of the shape of a card, and a tape in a disk, if a storage may be a magnetic disk and is a medium which has a disk-like truck.

(Additional remark 1) The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, In and the condition of having laid the base by which was equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage, and resist spreading was carried out on said rotation stage, and having made it rotating By irradiating on this base and exposing an electron beam from said electron beam irradiation equipment Mastering equipment characterized by having the driving gear which drives said direct-acting stage so that it may move to the predetermined distance [every] intermittence target which is mastering equipment which manufactures disk original recording, and by which said direct-acting stage was appointed beforehand.

(Additional remark 2) It is mastering equipment given in the additional remark 1 characterized by for said electron beam irradiation equipment irradiating an electron beam on said base when said direct-acting stages are [a idle state and said rotation stage] operating state, and performing adjustment of the

exposure location of said electron beam of the migration direction of said direct-acting stage with the polariscope prepared in said electron beam irradiation equipment.
(Additional remark 3) The driving gear which drives said rotation stage when said electron beam irradiation equipment irradiates an electron beam on said base is mastering equipment the additional remark 1 characterized by operating so that the rotational speed of said rotation stage may be held to the constant speed which axial blurring cannot produce easily, or given in 2.
(Additional remark 4) It is mastering equipment of any one publication of three from the additional remark 1 characterized by for said electron beam irradiation equipment repeating the same electron beam exposure of the count of predetermined in the same part on said base when it turns out beforehand that exposure runs short in the exposure of the electron beam of the once to said base top by said electron beam irradiation equipment, and suspending actuation of said direct-acting stage in the meantime.
(Additional remark 5) The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, And it is the manufacture approach of the storage substrate which uses the mastering equipment equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage. In the condition that laid the disk original recording by which resist spreading was carried out on said rotation stage, and actuation of said direct-acting stage has stopped Said disk original recording is rotated with a fixed rotational speed by said rotation stage. Irregularity is formed on disk original recording by being deviation within the limits of an electron beam, irradiating said electron beam irradiation equipment to an electron beam on this disk original recording, and exposing. When the exposure in deviation within the limits of the electron beam by said electron beam irradiation equipment is completed Were able to appoint said direct-acting stage beforehand, carry out predetermined distance migration, and it is made to stop. Henceforth The exposure in deviation within the limits of said electron beam irradiation equipment to an electron beam, The manufacture approach of the storage substrate characterized by repeating migration of an intermittent predetermined distance of said direct-acting stage, creating La Stampa from said disk original recording, performing injection molding of a transparent material using this La Stampa, and obtaining a storage substrate.
(Additional remark 6) The mastering equipment of any one publication of four from the additional remark 1 characterized by to locate the exposure starting position to said base and the exposure termination location of said electron beam on a different radius line in order that the exposure of the electron beam to said base top by said electron beam irradiation equipment may make criteria distance predetermined distance which it is spiral and said direct-acting stage moves in one actuation, and which was defined beforehand to a base.
(Additional remark 7) It is mastering equipment of any one publication of three from the additional remark 1 characterized by for said electron beam irradiation equipment repeating the same electron beam exposure of the count of predetermined successively in the same part on said base gone around when it turns out beforehand that exposure runs short in the exposure of the electron beam of the once to said base top by said electron beam irradiation equipment, and suspending actuation of said direct-acting stage in the meantime.
(Additional remark 8) It is mastering equipment of any one publication of three from the additional remark 1 characterized by for said electron beam irradiation equipment repeating the same electron beam exposure of the count of predetermined successively in the same part for two or more rounds on said base when it turns out beforehand that exposure runs short in the exposure of the electron beam of the once to said base top by said electron beam irradiation equipment, and suspending actuation of said direct-acting stage in the meantime.
(Additional remark 9) The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, And it is the manufacture approach of the storage substrate which uses the mastering equipment equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage. In the condition that laid the disk original recording by which resist spreading was carried out on said rotation stage, and

actuation of said direct-acting stage has stopped Said disk original recording is rotated with a fixed rotational speed by said rotation stage. Irregularity is formed on disk original recording by being deviation within the limits of an electron beam, irradiating said electron beam irradiation equipment to an electron beam on this disk original recording, and exposing. When the exposure in deviation within the limits of the electron beam by said electron beam irradiation equipment is completed Were able to appoint said direct-acting stage beforehand, carry out predetermined distance migration, and it is made to stop. Henceforth The exposure in deviation within the limits of said electron beam irradiation equipment to an electron beam, The manufacture approach of the storage substrate characterized by creating La Stampa for repeating migration of an intermittent predetermined distance of said direct-acting stage, and making a storage substrate from said disk original recording.
(Additional remark 10) The stage device which consists of a direct-acting stage and a rotation stage prepared on this direct-acting stage, And it is the manufacture approach of the storage substrate which uses the mastering equipment equipped with the electron beam irradiation equipment which irradiates the electron beam from the source for drawing of a beam on said rotation stage. In the condition that laid the disk original recording by which resist spreading was carried out on said rotation stage, and actuation of said direct-acting stage has stopped Said disk original recording is rotated with a fixed rotational speed by said rotation stage. Irregularity is formed on disk original recording by being deviation within the limits of an electron beam, irradiating said electron beam irradiation equipment to an electron beam on this disk original recording, and exposing. When the exposure in deviation within the limits of the electron beam by said electron beam irradiation equipment is completed Were able to appoint said direct-acting stage beforehand, carry out predetermined distance migration, and it is made to stop. Henceforth The exposure in deviation within the limits of said electron beam irradiation equipment to an electron beam, Repeat migration of an intermittent predetermined distance of said direct-acting stage, and La Stampa is created from said disk original recording. The manufacture approach of the storage substrate which performs injection molding of a transparent material using this La Stampa, and is characterized by carrying out the laminating of record film and the protective coat on the created disk substrate, and manufacturing a storage substrate.
[0042]
[Effect of the Invention] As explained to the detail above, when exposing spirally to disk original recording using mastering equipment according to this invention A bigger distance than the track pitch of the pit train on disk original recording in the condition that make it move intermittently by the direct-acting stage, and disk original recording is rotating with constant speed By deflecting the direction of the electron beam by which outgoing radiation is carried out with deflecting system in 1 time of this direct-acting stage of a successive range from the electron gun of electron beam irradiation equipment Since the control limitation of a direct-acting stage and a rotation stage is compensated and exposure is performed on disk original recording, high-density and high-definition disk original recording can be manufactured, and it is effective in the ability to manufacture a high-density and high-definition storage substrate. Therefore, it is effective in the ability of a track pitch to manufacture a high density record medium 170nm or less.

[Translation done.]

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a whole block diagram about the configuration of mastering equipment and the block configuration of a control system which apply this invention.
[Drawing 2] It is the explanatory view comparing and showing the range which can draw by migration of the range which can draw, and a next direct-acting stage by one migration of a direct-acting stage in the mastering equipment of this invention.
[Drawing 3] It is the explanatory view showing the range on the disk media to which drawing is performed by the electron beam from the physical relationship of disk media and an electron beam column and an electron beam column when a direct-acting stage moves intermittently.
[Drawing 4] It is the top view of the disk original recording explaining the drawing range by the electron beam from an electron beam column when a direct-acting stage carries out criteria distance migration.
[Drawing 5] It is the diagram showing the location of the direct-acting stage by intermittent migration of the direct-acting stage of this invention with time amount.
[Drawing 6] (a) The partial enlarged drawing and (b) explaining the drawing condition of the pit to the disk original recording top by ********** It is a partial enlarged drawing explaining the condition of performing multiple-times drawing to the part on the disk original recording which drew once.
[Drawing 7] It is the sectional view showing another example of the configuration of the sample room of the mastering equipment used for this invention.
[Description of Notations]
1 -- Sample room
2 -- Control circuit
3 -- Electron beam column
5 -- Pit train
9 9A -- Mastering equipment of this invention
10 -- Vacuum chamber
12 42 -- Direct-acting stage
12A, 42A -- Movable carriage
12B -- Standing ways
13 -- Rotation stage
14 -- Disk original recording
16 -- Reflective mirror
19 -- Motor
20 -- Controller
22 -- Interferometer
27 -- Deviation amplifier
31 -- Electron gun
33 -- Branka
35 -- Deflecting system

40 -- Air spindle motor

[Translation done.]

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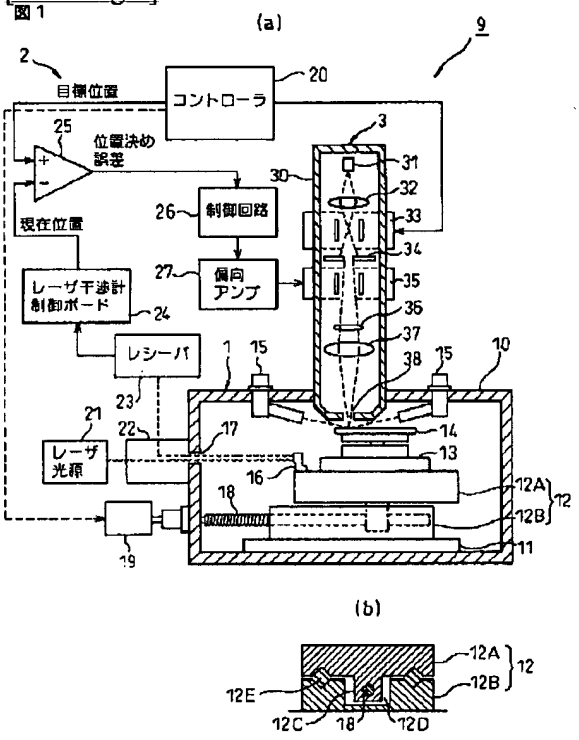
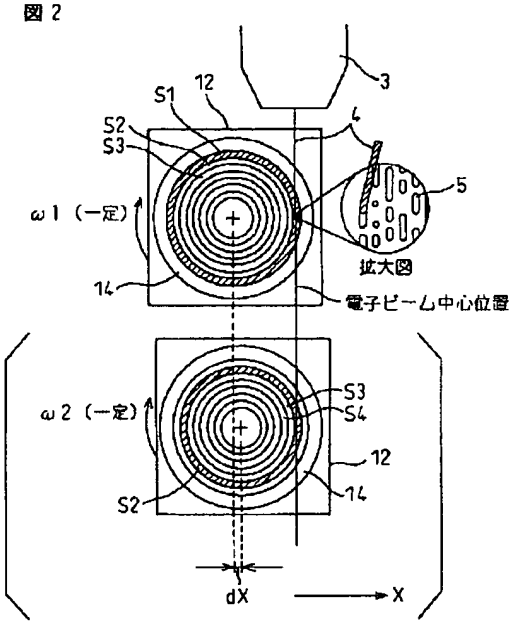
DRAWINGS

[Drawing 1]



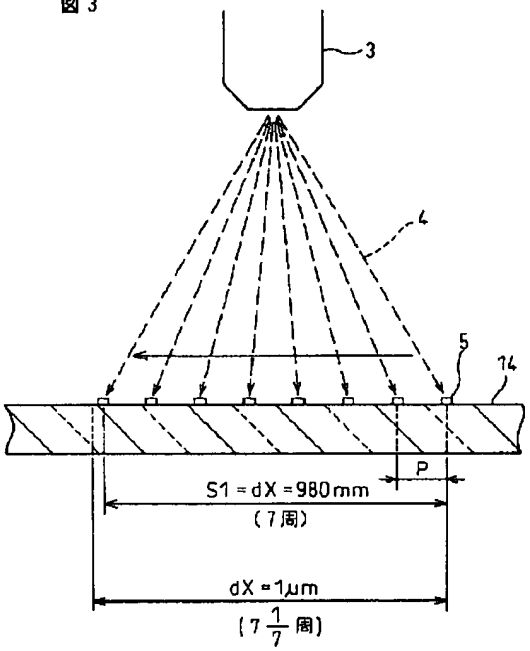
[Drawing 2]

図 2



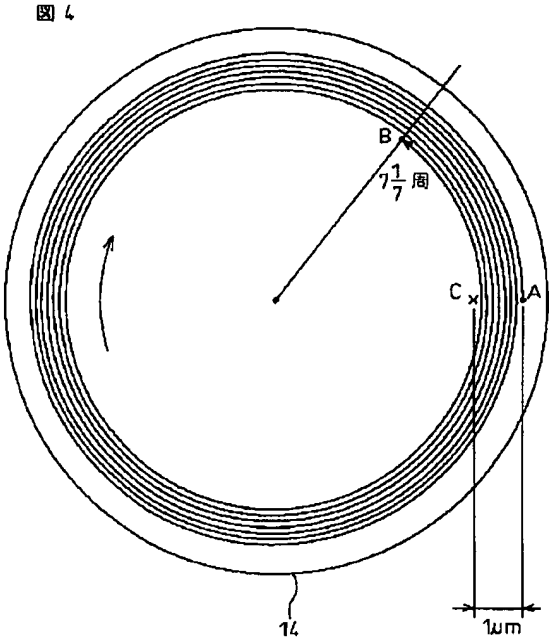
[Drawing 3]

図 3



[Drawing 4]

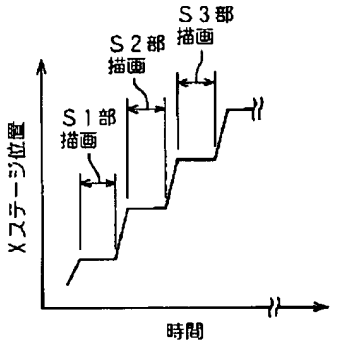
図 4



[Drawing 5]

図 5

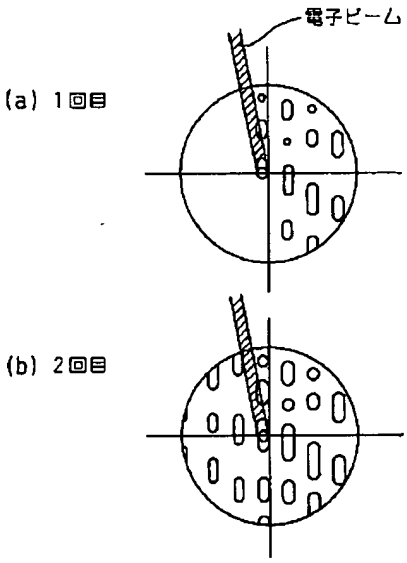
本発明による描画時刻とステージの動き



[Drawing 6]

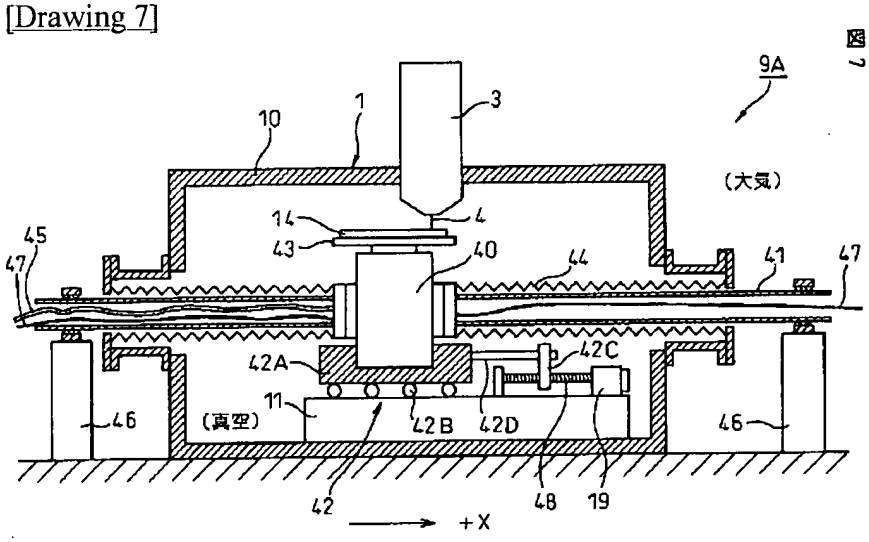
図 6

同一個所の複数回描画例
（描画箇所拡大図）



[Drawing 7]

図 7



[Translation done.]